DOCUMENT RESUME

ED 281 776 SE 047 970

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TITLE Predicting Grades in Chemistry 101.
PUB DATE Jan 86
NOTE 13p.
PUB TYPE Reports - Research/Technical (143)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Academic Aptitude; *Chemistry; *College Science; *Grade Prediction; Higher Education; *Predictive Measurement; Science Education; *Student Characteristics
IDENTIFIERS *Science Education Research

ABSTRACT

This study was designed to help students decide whether or not to register for a general chemistry course. High school grade point averages (GPAs) and American College Testing (ACT) scores were obtained on over 600 students from New Mexico State University and were entered into correlation analysis with chemistry grades. A "Chemistry GPA" was determined for each ACT score and for each interval of 0.1 in the high school GPA and then was plotted versus the appropriate ACT scores or high school GPAs. It was found that students who had a high school GPA below 3.3 or a composite ACT score below 19 had less than a 50 percent chance of obtaining a grade of C or better in the general chemistry course. Courses are suggested for students to take prior to taking the general chemistry course. (ML)

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PREDICTING GRADES IN CHEMISTRY 101

by

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U.S. DEPARTMENT OF EDUCATION
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SE 047 970

Predicting Grades in Chemistry 101

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New Mexico State University (1985)

Introduction

General Chemistry has a reputation at most Universities that places it among the more difficult courses at the freshman level. New Mexico State University is no exception. Over several years the number of unsatisfactory grades (Ds, Fs & Ws) have remained nearly constant at about 40% in Chemistry 101. The study was conducted with the hope that it would help advisors and students to decide whether or not to select Chemistry 101 at registration.

The current Bulletin (June 1985) lists any of the following as a prerequisite for Chemistry 101:

1. A "B" or better obtained in high school Chemistry.
2. Credit obtained in Chemistry 100.
3. Eligible to take Math 115.

While these prerequisites seem reasonable some other possible prerequisites are suggested in this paper.

Procedure

The high school GPA's and the ACT scores were obtained for all the students who took Chemistry 101 during the fall semester in 1982. Not all records were complete but records in each area were obtained on over 600 students. These numbers were correlated with the grades earned by the students in Chemistry 101.

For each ACT score and for each interval of 0.1 in the high school GPA, a "Chemistry GPA" was determined. These "Chemistry GPA's" were plotted vs the appropriate ACT scores or high school GPA's. The plots are attached. The Chemistry GPA is called the Average Chem 101 Grade.

Discussion

High School GPAs. As can be seen in Fig. 1, a plot of high school GPA vs average Chemistry grade is not linear. Up to a GPA of nearly 3.5 the slope is relatively low while above 3.5 the line is much steeper. This seems to agree with Ozsogomonyan and Loftus [J.Chem. Educ. 56, 173 (1979)] who compared high school Chemistry grades at Berkeley with the grades obtained in college Chemistry. They found that a "C" in high school chemistry meant nothing. Students with no high school chemistry did as well in general chemistry as those who made a "C". A "B" in high school chemistry was a slightly positive indicator of success in College chemistry while an "A" was a good indicator of success (only 2% got D's or F's in college chemistry).

Figure 1 indicates that NMSU students are likely to have trouble with college chemistry if their high school GPA was lower than 3.3. One wonders about high school grade inflation if a high school GPA of 3.3 corresponds to a college chemistry grade of 1.5.

Social Science ACT Scores. If one takes the slope of a plot of ACT scores vs. average Chemistry 101 grade (GPA) as an indication of the value of the test score for Chem 101 grade predictions, then the Social Science ACT Score is the least valuable of the ACT scores for predicting general chemistry performance (see Fig. 2). The plot, however, was quite linear and the linear regression line indicates that a score of 16 corresponds to a college chemistry GPA of 1.5. The average chemistry GPA of 1.5 was selected because it is roughly the point where a student has a 50% chance to pass Chem 101. The results are summarized in Table 1.

Natural Science ACT Scores. As can be seen in Fig 3, the Natural Science ACT Score is somewhat better at predicting Chemistry 101 performance than is the Social Science Score. A Natural Science ACT Score of 21 corresponds with a general chemistry GPA of 1.5.

Mathmatics ACT Scores. Most chemists would not be surprised to find a strong correlation between the Mathmatics ACT Score and success in Chemistry 101. Remedial Chemistry texts spend more time on problem solving than any other topic. Several studies have reported using SAT math scores as a means of predicting general chemistry performance. Pickering [J. Chem. Educ. 54, 433 (1977)] says that students with Math SAT Scores below 630 are high risk chemistry students and he has used 610 as a cut-off score for admission to general chemistry. Ozsogomonyan and Loftus [J. Chem. Educ. 56, 173 (1979)] stated that SAT Math Scores needed to be above 550 so that students would have a better chance for an "A" or a "B" than for a "D" or an "F" at Berkeley.

Fig. 1

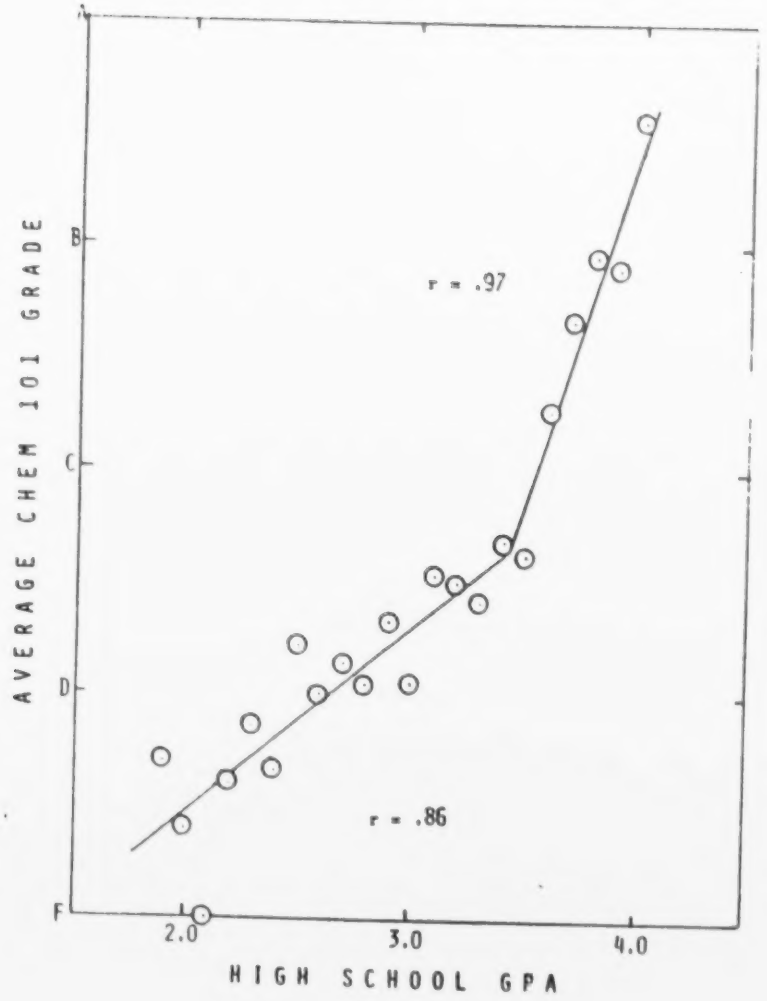
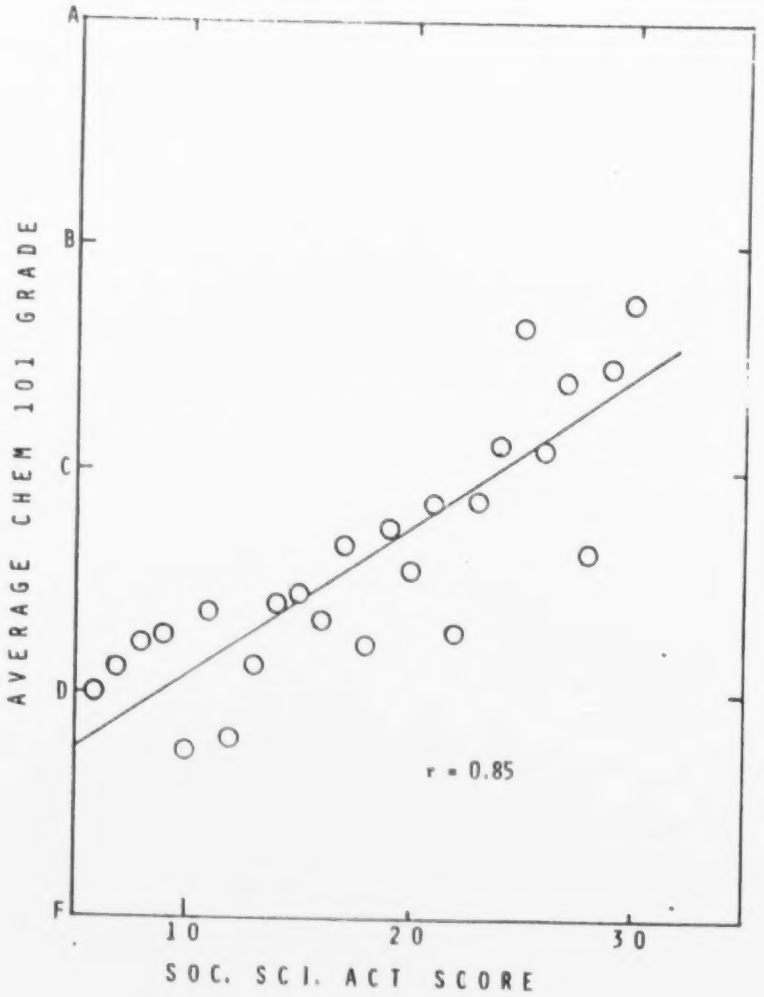

AVERAGE CHEM 101 GRADE
A
B
C
D
F
r = .97
r = .86
2.0
3.0
4.0
HIGH SCHOOL GPA

Fig. 2


AVERAGE CHEM 101 GRADE
A
B
C
D
F
r = 0.85
10
20
30
SOC. SCI. ACT SCORE

Finally Andrews & Andrews [J. Chem. Educ. 56, 231 (1979)] stated that students with Math SAT Scores below 600 did very poorly in general chemistry. No studies were found in the literature where chemistry grades were correlated with ACT Mathmatics scores.

In this study the Math ACT Score was a good indicator of Chemistry 101 success as is illustrated in Fig. 4. A Math ACT Score of 18 corresponded to reach a GPA of 1.5 for general chemistry.

English ACT Scores. It is interesting to note that the English ACT Score is possibly a little better for predicting Chemistry 101 grades than was the Math score. This clear importance of abilities in English in the success of Chemistry 101 students has led me to include a reading assignment with a written book report in the requirements for our remedial course, Chem 100.

Composite ACT Scores. The composite ACT Score was very much like the Math and English ACT scores in indicating how a student will do in Chemistry 101. It appears to be slightly better than either the math or the ENglish scores both in slope (Fig. 6) and in correlation coefficient. The ACT score that corresponds with a 1.5 GPA in general chemistry is 19 which agrees with Shearer and Nicholson (190th ACS Meeting, Chicago, Ill. 1985) who found that an ACT composite score of 18 was necessary for students to expect a C or better in general chemistry at Fort Hays State University. This is nearly the same as the 19 reported here. Shearer & Nicholson reported that the Composite ACT Score correlates better with Chemistry grades than the Math ACT and they also report that the Iowa Placement Exam is even better at predicting general chemistry performance.

Fig. 3

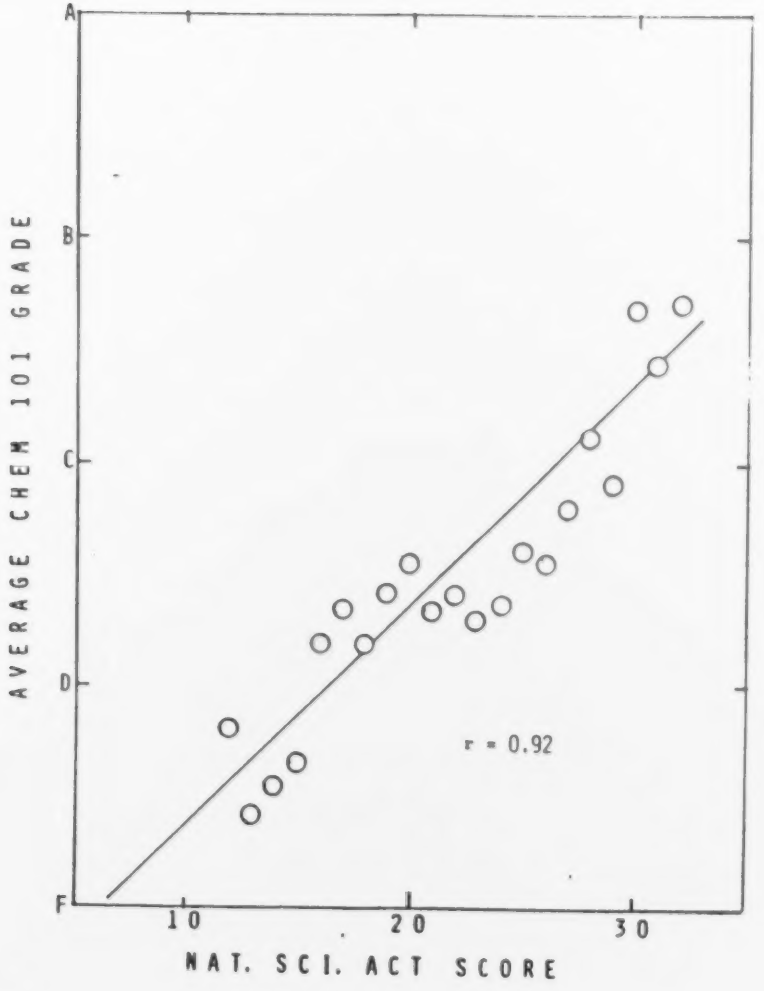

A
B
C
D
F
AVERAGE CHEM 101 GRADE
r = 0.92
10
20
30
NAT. SCI. ACT SCORE

Fig. 4

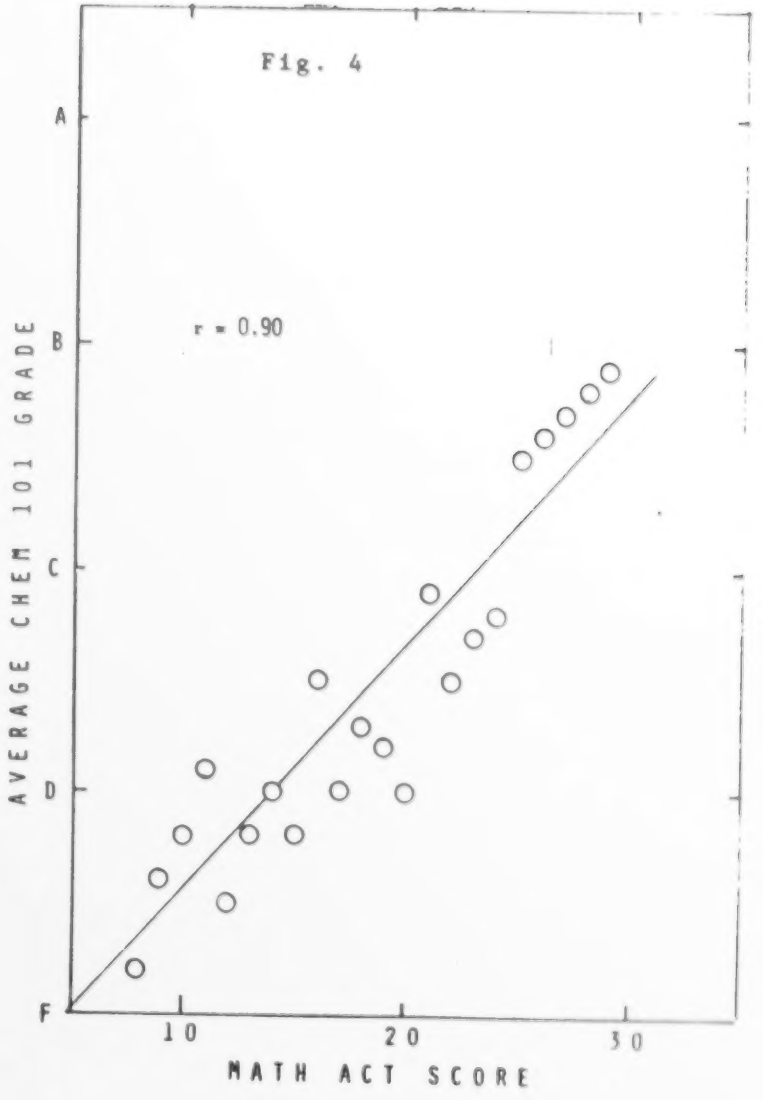

A
B
C
D
F
AVERAGE CHEM 101 GRADE
r = 0.90
10
20
30
MATH ACT SCORE

Fig. 5

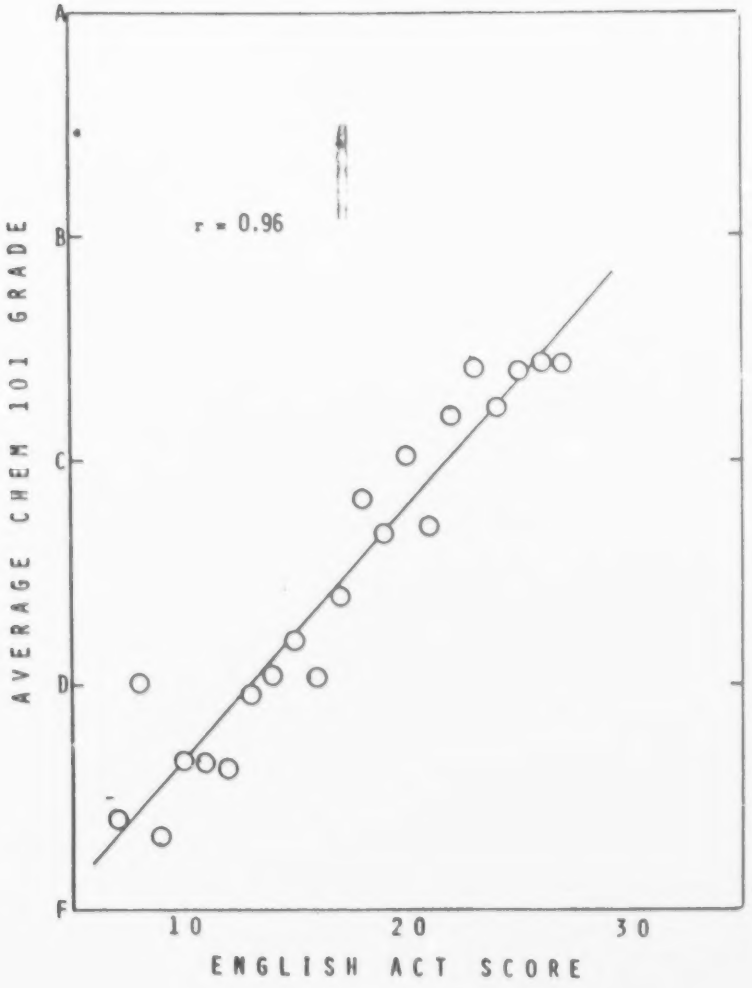
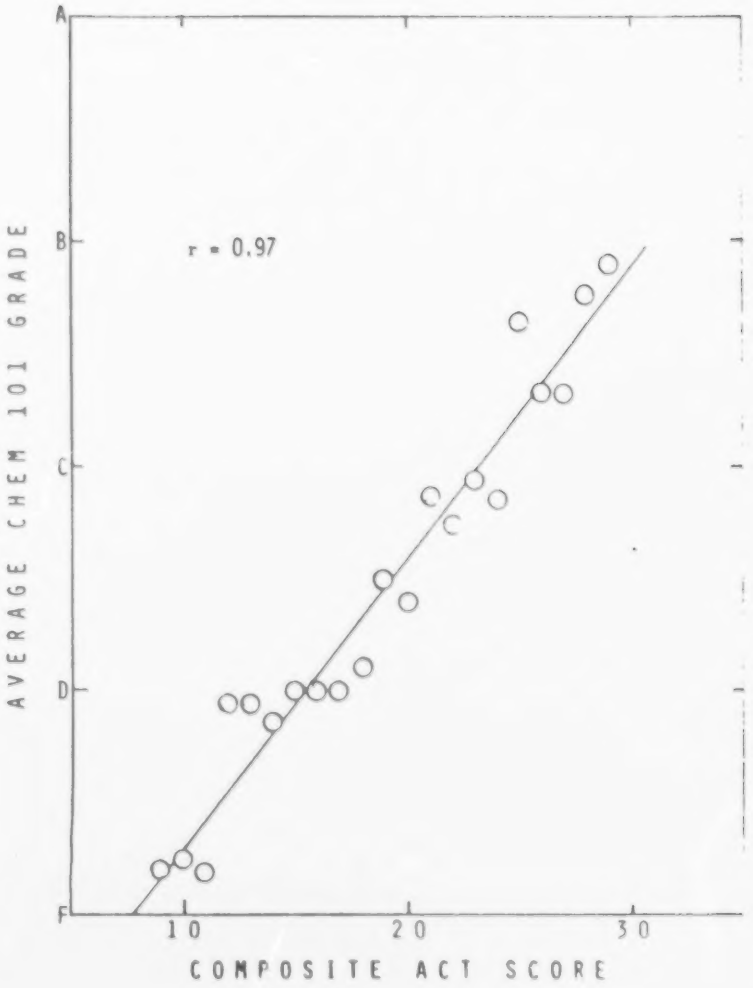

A
B
C
D
F
r = 0.96
AVERAGE CHEM 101 GRADE
10
20
30
ENGLISH ACT SCORE

Fig. 6


A
B
C
D
F
r = 0.97
AVERAGE CHEM 101 GRADE
10
20
30
COMPOSITE ACT SCORE

SUMMARY AND CONCLUSIONS

TABLE I

ACT Scores vs. Chem 101 Grades

	Score Predicting a Chem GPA of 1.5	Slope GPA/ACT	Correlation Coefficient
Social Science	16	.065	0.85
Natural Science	21	.094	0.92
Mathmatics	18	.107	0.90
English	17	.113	0.96
Composite	19	.129	0.97

Students who have a high school GPA below 3.3 or a composite ACT score below 19 have less than a 50% chance of obtaining a grade of C or better in Chemistry 101. Such students should probably take one or more of the following classes prior to taking Chem 101:

English 101N

Math 102

Chem 100